Docket No.: BBNT-P01-253
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Basu et al.

Application No.: 10/652,255 Confirmation No.: 1970

Filed: August 29, 2003 Art Unit: 2442

For: SYSTEMS AND METHODS FOR AUTOMATICALLY PLACING NODES IN AN AD HOC NETWORK Examiner: J. M. Macilwinen

APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This Appeal Brief is submitted in response to the Final Office Action mailed April 9, 2008, and in support of the Notice of Appeal filed September 9, 2008.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is BBN Technologies Corp.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-55 are pending in this application. Claims 1-55 were finally rejected in the Office Action dated April 9, 2008 and are the subject of the present appeal. Claims 1-55 are reproduced in the Claim Appendix of this Appeal Brief.

IV. STATUS OF AMENDMENTS

No Amendment has been filed subsequent to the Final Office Action mailed April 9, 2008. Appellants did, however, file an After Final Request for Reconsideration on August 11, 2008. A subsequent Advisory Action, dated August 29, 2008 indicated that the Request for Reconsideration was not persuasive..

V. SUMMARY OF CLAIMED SUBJECT MATTER

Each of the independent claims involved in this appeal is recited below, followed in parenthesis by examples of where support can be found in the specification and drawings for the claimed subject matter. In addition, each dependent claim argued separately below is also summarized in a similar manner.

Claim 1 recites: A method for achieving biconnectivity in a network that includes a plurality of nodes, the method comprising: forming blocks from groups of one or more of the nodes in the network (e.g., 830, Fig. 8; page 19, line 11 – page 20, line 11); selecting one of the blocks as a root block (e.g., 840, Fig. 8; page 21, line 18 – page 22, line 2); identifying other ones of the blocks as leaf blocks (e.g., 850, Fig. 8; page 21, line 18 – page 22, line 2); and collectively moving the nodes in one or more of the leaf blocks to make the network biconnected (e.g., 860, Fig. 8; page 22, lines 3-8).

Claim 19 recites: A system for achieving biconnectivity in a network that includes a plurality of nodes, comprising: means for grouping subsets of the nodes into blocks (e.g., 240, Fig.

2; page 19, line 11 – page 20, line 11); means for identifying cutvertices in the network (e.g., 240, Fig. 2; page 19, line 11 – page 20, line 11); and means for collectively moving the subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network (e.g., 240; page 22, lines 3-8).

Claim 21 recites: In a network that includes a plurality of nodes, at least one of the nodes comprising: a network device that is capable of moving within the network (e.g., 210, Fig. 2; page 10, lines 4-11); and a movement controller (e.g., 240, Fig. 2; page 10, lines 12-15) configured to: generate a current view of the network (e.g., 820, Fig. 8; page 18, lines 4-8), form blocks from groups of one or more of the nodes in the network based on the current view of the network (e.g., 830, Fig. 8; page 19, line 11 – page 20, line 11), and identify one or more of the blocks, as one or more identified blocks, to move to make the network biconnected (e.g., 850, 860, Fig. 8; page 21, line 18 – page 22, line 8).

Claim 38 recites: A method for achieving biconnectivity in a network that includes a plurality of nodes, the method comprising: generating a graph of the network (e.g., 830, Fig. 8; page 19, line 11 – page 20, line 11); identifying cutvertices in the network (e.g., page 19, 11 – page 20, line 11); and causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network (e.g., 860, Fig. 8; page 22, lines 3-8).

Claim 39 recites: A method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the method comprising: identifying one or more of the nodes to move (e.g., 610, Fig. 6; page 15, lines 15-19); determining direction and distance to move the one or more nodes (e.g., 630, Fig. 6; page 16, lines 7-11); and

moving the one or more nodes in the determined direction and distance to transform the non-biconnected network to a biconnected network (e.g., 640, Fig. 6; page 16, lines 7-11).

Claim 43 recites: The method of claim 39, wherein the determining direction and distance to move includes: determining a geographic center of the non-biconnected network (e.g., 620, Fig. 6; page 16, lines 1-6), and determining weighted distances for moving the one or more nodes toward the geographic center (e.g., 630, Fig. 6; page 16, lines 7-11).

Claim 46 recites: A method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the method comprising: determining a geographic center of the non-biconnected network (e.g., 620, Fig. 6; page 16, lines 1-6); and moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network (e.g., 640, Fig. 6; page 16, lines 7-11).

Claim 47 recites: In a network that includes a plurality of nodes, at least one of the nodes comprising: a network device that is capable of moving within the network (e.g., 210, Fig. 2; page 10, lines 4-11); and a movement controller (e.g., 240, Fig. 2; page 10, lines 12-15) configured to: determine locations of the nodes (e.g., 610, Fig. 6; page 15, lines 15-19), identify a geographic center of the network based on the locations of the nodes (e.g., 620, Fig. 6; page 16, lines 1-6), and determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network (e.g., 630, Fig. 6; page 16, lines 7-11).

Claim 48 recites: A system for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the system comprising: means for identifying a geographic center of the non-biconnected network based on current locations of the nodes (e.g., 240, Fig. 2; page 16, lines 1-6); and means for causing each of one or more of the nodes to move towards the geographic

center to transform the non-biconnected network to a biconnected network (e.g., 240, Fig. 2; page 16, lines 7-11).

Claim 49 recites: A computer-readable medium that includes instructions that when executed by at least one processor causes the processor to perform a method for achieving biconnectivity in a network that includes a plurality of nodes, the computer-readable medium comprising: instructions for determining a current topology of the network (e.g., 820, Fig. 8; page 18, lines 4-8); instructions for identifying cutvertices in the network based on the current topology of the network (e.g., page 19, line 11 – page 20, line 11); instructions for identifying one or more of the nodes in the network to move (e.g., page 21, line 18 – page 22, line 2); and instructions for causing each of the identified one or more nodes to move in a particular direction to systematically remove the cutvertices from the network and form a biconnected network (e.g., page 22, lines 3-8).

Claim 50 recites: A method for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes, comprising: determining initial positions of the nodes in the one-dimensional non-biconnected network (e.g., 410, Fig. 4; page 12, lines 7-10); determining a movement schedule for the nodes using one or more linear programming techniques (e.g., 420, Fig. 4; page 12, lines 11-20); and causing one or more of the nodes to move based on the determined movement schedule to form a biconnected network from the one-dimensional non-biconnected network (e.g., 430, Fig. 4; page 15, lines 4-7).

Claim 54 recites: A system for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes, comprising: means for determining initial positions of the nodes in the one-dimensional non-biconnected network (e.g., 240, Fig. 2; page 12, lines 7-10); means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional

non-biconnected network (e.g., 420, Fig. 4; page 12, line 11 – page 15, line 3); and means for causing one or more of the nodes to move based on the determined movement schedule to achieve biconnectivity in the one-dimensional non-biconnected network (e.g., 240, Fig. 2; page 15, lines 4-7).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 1-7, 9-19, 21-28, 30-37, and 40-42 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al. in view of Li et al. and Templin (U.S. Patent Application Publication No. 2001/0040895).

B. Claims 8 and 29 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al., Li et al., and Templin in view of Jennings et al. ("Topology Control for Efficient Information Dissemination in Ad-hoc Networks").

C. Claim 20 has been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al., Li et al., and Templin in view of Liao et al. ("GRID: A Fully Location-Aware Routing Protocol for Mobile Ad Hoc Networks").

D. Claims 38, 39, and 49 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al. ("Improved Approximation Algorithms for Biconnected Subgraphs via Better Lower Bounding Techniques") in view of Li et al. ("Sending Messages to Mobile Users in Disconnected Ad-hoc Wireless Networks").

E. Claims 43, 44, 46, and 47 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al., Li et al., and Liao et al. in view of Gibson et al. (U.S. Patent No. 6,362,821).

F. Claim 45 has been rejected under 35 U.S.C. § 103(a) as unpatentable over Garg et al., Li et al., Liao et al., and Gibson et al. in view of Proctor, Jr. et al. (U.S. Patent No. 5,960,047).

G. Claim 48 had been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Garg et al. and Li et al. in view of Liao et al.

H. Claims 50-52 and 54 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Hsu ("Simpler and Faster Biconnectivity Augmentation") in view of Li et al.

I. Claims 53 and 55 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Hsu and Li et al. in view of Lin et al. ("Adaptive Clustering for Mobile Wireless Networks").

VII. ARGUMENT

A. The rejection under 35 U.S.C. § 103 based on Garg et al., Li et al., and Templin should be reversed.

The initial burden of establishing a *prima facie* basis to deny patentability to a claimed invention always rests upon the Examiner. In re Oetiker, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In rejecting a claim under 35 U.S.C. § 103, the Examiner must provide a factual basis to support the conclusion of obviousness. In re Warner, 379 F.2d 1011, 154 USPQ 173 (CCPA 1967). Based upon the objective evidence of record, the Examiner is required to make the factual inquiries mandated by Graham v. John Deere Co., 86 S.Ct. 684, 383 U.S. 1, 148 USPQ 459 (1966). KSR International Co. v. Teleflex Inc., 550 U.S. ___,127 S. Ct. 1727 (2007). The Examiner is also required to explain how and why one having ordinary skill in the art would have been realistically motivated to modify an applied reference and/or combine applied references to arrive at the claimed invention. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988).

1. Claim 1

Claim 1 is directed to a method for achieving biconnectivity in a network that includes a plurality of nodes. The method comprises forming blocks from groups of one or more of the nodes

in the network; selecting one of the blocks as a root block; identifying other ones of the blocks as leaf blocks; and collectively moving the nodes in one or more of the leaf blocks to make the network biconnected.

Garg et al., Li et al., and Templin, whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 1. For example, Garg et al., Li et al., and Templin do not disclose or suggest collectively moving nodes in one or more of the leaf blocks to make the network biconnected.

The Examiner admitted that Garg et al. does not disclose or suggest moving one or more leaf blocks (final Office Action, pg. 10). The Examiner alleged that Li et al. discloses moving nodes, but admitted that Li et al. does not disclose or suggest that node movements are done in blocks (final Office Action, pg. 10). The Examiner alleged that Templin discloses that "node movement should be minimized, as it results in increased transmissions and can temporarily diminish network performance" and cited paragraph 0039 of Templin for support (final Office Action, pg. 11). Even assuming, for the sake of argument, that Templin discloses exactly what the Examiner alleged (a point that Appellants do not concede), the Examiner has not established a *prima facie* case of obviousness and, in fact, the Examiner has asserted that Templin teaches away from collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1, because collectively moving nodes might not minimize node movement.

At paragraph 0039, Templin discloses:

> In one embodiment, the subnet 10 is a mobile "ad hoc" network ("MANET") in that the topology of the subnet 10 and the state of the links (i.e., link state) between the nodes 18 in the subnet 10 can change frequently because several of the nodes 18 are mobile. That is, each mobile node 18 may move from one location to another location within the same subnet 10 or to another subnet 20, dynamically breaking existing links and establishing new links with other nodes 18, 18' as a result. Such movement by one node 18 does not necessarily

> result in breaking a link, but may diminish the quality of the communications with another node 18 over that link. In this case, a cost of that link has increased. Movement that breaks a link may interrupt any on-going communications with other nodes 18 in the subnet 10 or in the foreign subnet 20, or with servers (e.g., server 40) connected to the Internet 30. In another embodiment, the position of every node 18 in the subnet 10 is fixed (i.e., a static network configuration in which no link state changes occur due to node mobility). As the principles of the invention apply to both static and dynamic network configurations, a reference to the subnet 10 contemplates both types of network environments.

In this section, Templin discloses that movement of a node may diminish the quality of communications over a link or break a link that interrupts on-going communication with other nodes. Nowhere in this section, or elsewhere, does Templin disclose or suggest collectively moving nodes, let alone collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1.

The Examiner appears to also allege that Li et al. discloses collectively moving nodes and cited sections 1, 5, and 5.1 of Li et al. for support (final Office Action, pg. 10). Appellants submit that the disclosure of Li et al. provides no support for the Examiner's allegation.

As noted above, in section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path between hosts A and B. This section of Li et al. discloses moving nodes to send a message. This section of Li et al. does not disclose or suggest collectively moving nodes in one or more of the leaf blocks to make a network biconnected, as recited in claim 1.

In section 5, Li et al. discloses a method in which mobile hosts inform other hosts of their current position. Nowhere in this section, or elsewhere, does Li et al. disclose or suggest collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1. In fact, Li et al. is not concerned with whether a network is biconnected.

Instead, Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts (section 1).

In section 5.1, Li et al. discloses a situation where two hosts want to communicate with each other and these hosts keep track of the other hosts' location. Nowhere in this section, or elsewhere, does Li et al. disclose or suggest collectively moving nodes, let alone collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1. In fact, Li et al. is not concerned with whether a network is biconnected. Instead, Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts (section 1).

In response to similar arguments made in a previous response, the Examiner alleges that "[b]y continuing to utilize the blocks of nodes formed by Garg, and by moving nodes but seeking to maintain their neighbors, taught by Li, and where Templin further teaches that breaking/changing node relationships increases link costs and interrupts transmissions, collective block movements are taught" (final Office Action, pg. 9). Regardless of the validity of the Examiner's statement, claim 1 recites collectively moving nodes in one or more of the leaf blocks to make the network biconnected, not "collective block movements," as alleged by the Examiner. None of the references, whether taken alone or in any combination, discloses collectively moving nodes, let alone collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1.

Furthermore, Appellants object to the Examiner's piecemeal examination of the above feature of claim 1. That is, instead of addressing the feature of collectively moving nodes in one or more of the leaf blocks to make the network biconnected, the Examiner breaks the feature down into illogical parts by pointing to unrelated sections of three different references for allegedly disclosing

different parts of the feature. Such attempts at reconstructing Appellants' claims are clearly impermissible and clearly based solely on hindsight.

For at least these reasons, Appellants submit that the rejection of claim 1 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin is improper. Accordingly, Appellants request that the rejection be reversed.

Claims 2-7 and 9-18 depend from claim 1. Therefore, Appellants submit that the rejection of these claims under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin is improper for at least the reasons given above with respect to claim 1. Accordingly, Appellants request that the rejection be reversed.

2. Claim 19

Claim 19 is directed to a system for achieving biconnectivity in a network that includes a plurality of nodes. The system includes means for grouping subsets of the nodes into blocks; means for identifying cutvertices in the network; and means for collectively moving the subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network.

Garg et al., Li et al., and Templin, whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 19. For example, Garg et al., Li et al., and Templin do not disclose or suggest means for collectively moving a subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network.

The Examiner admitted that Garg et al. does not disclose or suggest moving subsets of nodes in one or more blocks (final Office Action, pg. 14). The Examiner alleged that Li et al. discloses moving nodes, but admitted that Li et al. does not disclose or suggest that node movements are done collectively in blocks (final Office Action, pg. 14). The Examiner alleged that Templin discloses

that "node movement should be minimized, as it results in increased transmissions and can temporarily diminish network performance" and cited paragraph 0039 of Templin for support (final Office Action, pg. 14). Even assuming, for the sake of argument, that Templin discloses exactly what the Examiner alleged (a point that Appellants do not concede), the Examiner has not established a prima facie case of obviousness and, in fact, the Examiner has asserted that Templin teaches away from collectively moving nodes in one or more of the leaf blocks to make the network biconnected, as recited in claim 1, because collectively moving nodes might not minimize node movement.

As noted above, at paragraph 0039, Templin discloses that movement of a node may diminish the quality of communications over a link or break a link that interrupts on-going communication with other nodes. Nowhere in this section, or elsewhere, does Templin disclose or suggest collectively moving nodes, let alone means for collectively moving a subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network, as recited in claim 19.

The Examiner appears to also allege that Li et al. discloses collectively moving nodes and cited section 5.1 of Li et al. for support (final Office Action, pg. 14). Appellants submit that the disclosure of Li et al. provides no support for the Examiner's allegation.

In section 5.1, Li et al. discloses a situation where two hosts want to communicate with each other and these hosts keep track of the other hosts' location. Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts. As noted above, in section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path

between hosts A and B (section 1). This section of Li et al. discloses moving nodes to send a message. This section of Li et al. does not disclose or suggest means for collectively moving a subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network, as recited in claim 19.

For at least these reasons, Appellants submit that the rejection of claim 19 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin is improper. Accordingly, Appellants request that the rejection be reversed.

3. Claim 21

Independent claim 21 is directed to at least one node in a network that includes a plurality of nodes. The at least one node comprises a network device that is capable of moving within the network; and a movement controller configured to generate a current view of the network, form blocks from groups of one or more of the nodes in the network based on the current view of the network, and identify one or more of the blocks, as one or more identified blocks, to move to make the network biconnected.

Garg et al., Li et al., and Templin, whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 21. For example, Garg et al., Li et al., and Templin do not disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected.

The Examiner alleged that this feature is disclosed by Garg et al. at sections 3.1, 4.1, and 4.4, Li et al. at sections 1 and 5, and Templin at paragraph 0039 (final Office Action, pp. 6 and 15).

Appellants submit that the disclosures of Garg et al., Li et al., and Templin do not support the Examiner's allegation.

In section 3.1, Garg et al. discloses an algorithm that picks a set of edges that form a 2-vertex connected spanning subgraph and partitions the vertices into blocks that are used to modify the set of edges. Although this section of Garg et al. discloses blocks, this section of Garg et al. does not disclose moving the blocks to make the network biconnected. Therefore, this section of Garg et al. does not disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21.

In section 4.1, Garg et al. discloses performing a tree carving of a graph by partitioning the vertex set into subsets. Assuming, for the sake of argument, that the subsets of Garg et al. can reasonably be construed as corresponding to the blocks of claim 21 (a point that Appellants do not concede), Garg et al. does not disclose or suggest moving the subsets to make a network biconnected, as would be required by Garg et al. based on the Examiner's interpretation of claim 21. Therefore, this section of Garg et al. does not disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21.

In section 4.4, Garg et al. discloses an algorithm that finds all 2-vertex connected components in a graph, creates a depth first search (DFS) tree in which all of the edges are included in the subgraph, and partitions the vertex set into blocks. Assuming, for the sake of argument, that the blocks of Garg et al. can reasonably be construed as corresponding to the blocks of claim 21 (a point that Appellants do not concede), Garg et al. does not disclose or suggest moving the blocks to

make a network biconnected, as would be required by Garg et al. based on the Examiner's interpretation of claim 21. Therefore, this section of Garg et al. does not disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21.

In section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to help. Nowhere in this section, or elsewhere, does Li et al. disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21. In fact, Li et al. is not concerned with whether a network is biconnected. Instead, Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts (section 1).

In section 5, Li et al. discloses a method in which mobile hosts inform other hosts of their current position. Nowhere in this section, or elsewhere, does Li et al. disclose or suggest a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21. In fact, Li et al. is not concerned with whether a network is biconnected. Instead, Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts (section 1).

In paragraph 0039, Templin discloses that movement of a node may diminish the quality of communications over a link or break a link and interrupt on-going communication with other nodes. Nowhere in this section, or elsewhere, does Templin disclose or suggest a movement controller,

within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21. In fact, since Templin discloses that the movement of a node is undesirable, Templin teaches away from a movement controller, within at least one node of a plurality of nodes in a network, that is configured to identify one or more blocks, as one or more identified blocks, to move to make a network biconnected, as recited in claim 21.

On pages 5-6 of the final Office Action, the Examiner argues that the combination of Garg et al., Li et al., and Templin discloses the above feature of claim 21. Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper and based solely on hindsight.

For at least these reasons, Appellants submit that the rejection of claim 21 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin is improper. Accordingly, Appellants request that the rejection be reversed.

Claims 22-28 and 30-37 depend from claim 21. Therefore, Appellants submit that the rejection of these claims under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin is improper. Accordingly, Appellants request that the rejection be reversed.

4. Claims 40-42

Claims 40-42 depend from claim 39. Without acquiescing in the Examiner's rejection of claims 40-42, Appellants submit that the disclosure of Templin does not remedy the deficiencies in the disclosures of Garg et al. and Li et al. set forth above with respect to claim 39. Therefore,

Appellants submit that the rejection of claims 40-42 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin be reversed for at least the reasons given with regard to claim 39.

B. The rejection under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin in view of Jennings et al. should be reversed.

1. Claim 8

Claim 8 depends from claim 1. Without acquiescing in the Examiner's rejection with regard to claim 8, Appellants submit that the disclosure of Jennings et al. does not cure the deficiencies in the disclosures of Garg et al., Li et al., and Templin identified above with regard to claim 1. Therefore, Appellants request that the rejection of claim 8 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Templin, and Jennings et al., be reversed for at least the reasons given with regard to claim 1.

2. Claim 29

Claim 29 depends from claim 21. Without acquiescing in the Examiner's rejection with regard to claim 29, Appellants submit that the disclosure of Jennings et al. does not cure the deficiencies in the disclosures of Garg et al., Li et al., and Templin identified above with regard to claim 21. Therefore, Appellants request that the rejection of claim 29 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Templin, and Jennings et al. be reversed for at least the reasons given with regard to claim 21.

C. The rejection under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Templin in view of Laio et al. should be reversed.

1. Claim 20

Claim 20 depends from claim 19. Without acquiescing in the Examiner's rejection with regard to claim 20, Appellants submit that the disclosure of Laio et al. does not cure the deficiencies in the disclosures of Garg et al., Li et al., and Templin identified above with regard to claim 19. Therefore, Appellants request that the rejection of claim 20 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Templin, and Liao et al. be reversed for at least the reasons given with regard to claim 19.

D. The rejection under 35 U.S.C. § 103(a) based on Garg et al. and Li et al. should be reversed.

1. Claim 38

Claim 38 is directed to a method for achieving biconnectivity in a network that includes a plurality of nodes. The method comprises generating a graph of the network; identifying cutvertices in the network; and causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network.

Garg et al. and Li et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 38. For example, Garg et al. and Li et al. do not disclose or suggest causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network.

The Examiner alleged that Garg et al., at sections 3.1.1 and Li et al., at section 1, disclose moving one or more of the nodes in the network to systematically remove the cutvertices from the network and form a biconnected network (final Office Action, pp. 20-21). Without acquiescing in the Examiner's allegation, Appellants submit that Garg et al. and Li et al. do not disclose or suggest

causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38.

In section 3.1.1, Garg et al. discloses an algorithm that picks a set of edges that form a 2-vertex connected spanning subgraph and partitions the vertices into blocks that are used to modify the set of edges. Nowhere in this section, or elsewhere, does Garg et al. disclose or suggest causing one or more of the nodes in the network to move, let alone causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38.

In section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to help. Nowhere in this section, or elsewhere, does Li et al. disclose or suggest causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38. In fact, Li et al. is not concerned with whether a network is biconnected. Instead, Li et al. is directed to algorithms for keeping a network connected where the network includes mobile hosts (section 1).

In the final Office Action, the Examiner alleges that Garg et al. discloses the "removing of the cutverticies from the network to form a biconnected network" (final Office Action, pg. 2). Appellants respectfully disagree with the Examiner's allegation.

As noted by the Examiner, Garg et al. discloses finding minimum 2-edge connected and 2-vertex connected subgraphs in a given graph (abstract). Finding minimum 2-edge connected and 2-vertex connected subgraphs in no way corresponds to systematically removing cutvertices from a network and forming a biconnected network by causing one or more nodes to move. Therefore,

Garg et al. does not disclose or suggest causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38.

The Examiner further alleges that "biconnected graphs are defined by a lack of cut vertices, and thus making a graph biconnected inherently results in the removal of cut vertices" (final Office Action, pg. 3). Regardless of the validity of the Examiner's statement, Garg et al. does not disclose systematically removing cutvertices from a network and forming a biconnected network by causing one or more nodes to move. Therefore, Garg et al. cannot disclose or suggest causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38.

Li et al. discloses causing a node to move in order to transmit messages. Garg et al. discloses changing edges to get a 2-vertex connection. The combination of Li et al. and Garg et al. would in no way result in causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network, as recited in claim 38. Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper.

For at least these reasons, Appellants submit that the rejection of claim 38 under 35 U.S.C. § 103(a) based on Garg et al. and Li et al. is improper. Accordingly, Appellants request that the rejection be reversed.

2. Claim 39

Independent claim 39 is directed to a method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes. The method comprises identifying one or more of the nodes to move; determining direction and distance to move the one or more nodes; and moving the one or more nodes in the determined direction and distance to transform the non-biconnected network to a biconnected network.

Garg et al. and Li et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 39. For example, Garg et al. and Li et al. do not disclose or suggest moving one or more nodes in a determined direction and distance to transform a non-biconnected network to a biconnected network.

The Examiner admitted that Garg et al. does not disclose this feature and cited section 1 of Li et al. for support (final Office Action, pp. 4 and 21-22). Appellants submit that the disclosure of Li et al. does not support the Examiner's allegation.

As noted above, in section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to help. This section of Li et al. discloses computing a trajectory for sending a message, and does not disclose or suggest moving one or more nodes in the determined direction and distance to transform a non-biconnected network to a biconnected network, as recited in claim 39.

The Examiner does not explain why one skilled in the art would reasonably construe Li et al.'s disclosure of computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to help as corresponding to moving one or more nodes in the determined direction and distance to transform a non-biconnected network to a biconnected network, as recited

in claim 39. Thus, a *prima facie* case of obviousness has not been established with regard to claim 39.

Li et al. discloses causing a node to move in order to transmit messages. Garg et al. discloses changing edges to get a 2-vertex connection. The combination of Li et al. and Garg et al. would in no way result in moving one or more nodes in the determined direction and distance to transform a non-biconnected network to a biconnected network, as recited in claim 39. Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper.

For at least these reasons, Appellants submit that the rejection of claim 39 under 35 U.S.C. § 103(a) based on Garg et al. and Li et al. is improper. Accordingly, Appellants request that the rejection be reversed.

3. Claim 49

Independent claim 49 is directed to a computer-readable medium that includes instructions that when executed by at least one processor causes the processor to perform a method for achieving biconnectivity in a network that includes a plurality of nodes, the computer-readable medium comprising: instructions for determining a current topology of the network; instructions for identifying cutvertices in the network based on the current topology of the network; instructions for identifying one or more of the nodes in the network to move; and instructions for causing each of the identified one or more nodes to move in a particular direction to systematically remove the cutvertices from the network and form a biconnected network.

Garg et al. and Li et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 49. For example, Garg et al. and Li et al. do not disclose or instructions for causing each of the identified one or more nodes to move in a particular direction to systematically remove the cutvertices from the network and form a biconnected network.

The Examiner alleged that Garg et al. discloses this feature and cited sections 1 and 3.1-3.1.2 of Garg et al. for support (final Office Action, pg. 29). Appellants submit that the disclosure of Garg et al. does not support the Examiner's allegation.

In section 1, Garg et al. discloses algorithms for approximating the minimum 2-vertex connected and 2-edge connected spanning subgraphs of a given undirected graph. Nowhere in this section, or elsewhere, does Garg et al. disclose or suggest determining a direction and distance to move one or more nodes, let alone moving one or more nodes in the determined direction and distance to transform a non-biconnected network to a biconnected network, as recited in claim 39. In fact, Garg et al. does not disclose moving nodes at all.

In section 3.1-3.1.2, Garg et al. discloses an algorithm that picks a set of edges that form a 2-vertex connected spanning subgraph and partitions the vertices into blocks that are used to modify the set of edges. Nowhere in this section, or elsewhere, does Garg et al. disclose or suggest determining a direction and distance to move one or more nodes, let alone moving one or more nodes in the determined direction and distance to transform a non-biconnected network to a biconnected network, as recited in claim 39. In fact, Garg et al. does not disclose moving nodes at all.

For at least these reasons, Appellants submit that the rejection of claim 39 under 35 U.S.C. § 103(a) based on Garg et al. and Li et al. is improper. Accordingly, Appellants request that the rejection be reversed.

E. The rejection under 35 U.S.C. § 103(a) based on Garg et al. and Li et al., Liao et al. and Gibson et al. should be reversed.

1. Claims 43 and 44

Claim 43 depends from claim 39. Without acquiescing in the Examiner's rejection of claims 43, Appellants submit that the disclosures of Liao et al. and Gibson et al. do not cure the deficiencies in the disclosures of Garg et al. and Li et al. identified above with regard to claim 39. Therefore, Appellants request that the rejection of claim 43 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. be reversed for at least the reasons given with regard to claim 39. Moreover, claim 43 recites an additional feature not disclosed or suggested by Garg et al., Li et al., Liao et al., and Gibson et al.

For example, claim 43 recites determining a geographic center of the non-biconnected network, and determining weighted distances for moving the one or more nodes toward the geographic center. The Examiner admitted that Garg et al. and Li et al. do not disclose the features recited in claim 43 (final Office Action, pg. 23). The Examiner alleged that Liao et al. discloses determining a geographic center of a network and cited sections 3.1 and 3.3 and pages 6, 8, and 15 of Liao et al. for support (final Office Action, pg. 23). Appellants have carefully reviewed each of these sections/pages identified by the Examiner and find absolutely no disclosure similar to determining a geographic center of a network as a direction to move one or more nodes, as recited

in claim 43. Instead, Liao et al. simply discloses selecting a gateway host of a grid as the one nearest to the physical center of the grid (sections 3.1 and 3.3).

The Examiner also admitted that Garg et al., Li et al., and Liao et al. do not disclose determining weighted distances for moving the one or more nodes toward the geographic center, as recited in claim 43 (final Office Action, pg. 23). The Examiner alleged that Gibson et al. discloses this feature and cited section 5, lines 1-7, of Gibson et al. for support (final Office Action, pg. 24). Appellants submit that the disclosure of Gibson et al. does not support the Examiner's allegation.

At column 5, lines 1-7, Gibson et al. discloses:

> As shown in FIG. 3, a first relaxation step 310 moves each node n[i] a distance determined by taking an average (weighted by distance) of the corresponding node q[i] in the other net. Updating the node could violate its constraint by lying outside its cell c[i]. If the new position of the node is outside the cell, then the node is moved to a closest point on the cell boundary.

In this section, Gibson et al. discloses moving nodes that represent objects on a three-dimensional surface (col. 3, lines 22-26). Contrary to the Examiner's assertion, just because this section of Gibson et al. uses the words "node," "weighted," and "distance" does not mean that this section of Gibson et al. discloses determining weighted distances for moving one or more nodes toward a geographic center, as recited in claim 43. In fact, Gibson et al. is related to generating a surface model for a three-dimensional object (col. 2, lines 20-21). The disclosure of Gibson et al. has absolutely nothing to do with communication networks. Due to the divergent subject matter of the Gibson et al. disclosure, there could be no reasonable explanation as to why one of ordinary skill in the art at the time of Appellants' invention would have sought to incorporate any feature of Gibson et al. into the combined system of Garg et al., Li et al., and Liao et al. absent impermissible hindsight.

In response to similar arguments made in a previous response, the Examiner alleges that "Gibson is relied upon to find the weighted distance a node would have to move" (final Office Action, pg. 7). However, as noted above, Gibson et al. has nothing to do with determining weighted distances for moving one or more nodes toward a geographic center, as recited in claim 43, and, in fact, has nothing to do with communication networks. Since the disclosure of Gibson et al. has absolutely nothing to do with communication networks, the Examiner has not established a *prima facie* case of obviousness with respect to claim 43.

Furthermore, Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper.

For at least these reasons, Appellants submit that the rejection of claim 43 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. is improper. Accordingly, Appellants request that the rejection be reversed.

Claim 44 depends from claim 43. Therefore, Appellants submit that the rejection of claim 44 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. is improper for at least the reasons given above with respect to claim 43. Accordingly, Appellants request that the rejection be reversed.

2. Claim 46

Claim 46 recites a method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes. The method includes determining a geographic center of the non-

biconnected network; and moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network.

Garg et al., Li et al., Liao et al., and Gibson et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 46. For example, Garg et al., Li et al., Liao et al., and Gibson et al. do not disclose or suggest determining a geographic center of the non-biconnected network; and moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network.

The Examiner appears to rely on section 1 of Li et al., sections 2.4 and 3.1-3.2 of Liao et al., and section 5, lines 1-7 of Gibson et al. as allegedly disclosing these features of calim 46 (final Office Action, pp. 25-26). Appellants respectfully disagree with the Examiner's interpretations of Li et al., Liao et al., and Gibson et al.

At section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path between hosts A and B. This section of Li et al. discloses moving hosts to send a message. Nowhere in the section, or elsewhere, does Li et al. disclose or suggest determining a geographic center of a non-biconnected network, let alone moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network, as recited in claim 46.

At sections 3.1-3.2, Liao et al. discloses selecting a gateway host of a grid as the one nearest to the physical center of the grid. This section of Liao et al. has nothing to do with determining a geographic center of a non-biconnected network, let alone moving each of one or more of the nodes

a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network, as recited in claim 46.

As noted above, at column 5, lines 1-7, Gibson et al. discloses moving nodes that represent objects on a three-dimensional surface (col. 3, lines 22-26). Contrary to the Examiner's assertion, just because this section of Gibson et al. uses the words "node," "weighted," and "distance" does not mean that this section of Gibson et al. discloses moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network, as recited in claim 46. In fact, Gibson et al. is related to generating a surface model for a three-dimensional object (col. 2, lines 20-21). The disclosure of Gibson et al. has absolutely nothing to do with communication networks. Due to the divergent subject matter of the Gibson et al. disclosure, there could be no reasonable explanation as to why one of ordinary skill in the art at the time of Appellants' invention would have sought to incorporate any feature of Gibson et al. into the combined system of Garg et al., Li et al., and Liao et al.

Furthermore, Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper.

For at least these reasons, Appellants submit that the rejection of claim 46 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. is improper. Accordingly, Appellants request that the rejection be reversed.

3. Claim 47

Claim 47 recites, in a network that includes a plurality of nodes, at least one of the nodes includes a network device that is capable of moving within the network; and a movement controller configured to: determine locations of the nodes, identify a geographic center of the network based on the locations of the nodes, and determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network.

Garg et al., Li et al., Liao et al., and Gibson et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 476. For example, Garg et al., Li et al., Liao et al., and Gibson et al. do not disclose or suggest a movement controller configured to identify a geographic center of a network based on locations of nodes, and determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network.

The Examiner admitted that Garg et al. and Li et al. do not disclose the features recited in claim 47 (final Office Action, pg. 27). The Examiner alleged that Liao et al. discloses determining a geographic center of a network and cited sections 3.1 and 3.3 and pages 6, 8, and 15 of Liao et al. for support (final Office Action, pg. 27). Appellants have carefully reviewed each of these sections/pages identified by the Examiner and find absolutely no disclosure similar to a movement controller configured to identify a geographic center of a network based on locations of nodes, and determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network, as recited in claim 47. Instead, Liao et al. simply discloses selecting a gateway host of a grid as the one nearest to the physical center of the grid (sections 3.1 and 3.3).

The Examiner also admitted that Garg et al., Li et al., Liao et al., and Gibson et al. do not disclose "where said movement is done according to a weighted distance" (final Office Action, pg. 28). The Examiner alleged that Gibson et al. discloses this feature and cited section 5, lines 1-7, of Gibson et al. for support (final Office Action, pg. 28). Appellants submit that the disclosure of Gibson et al. does not support the Examiner's allegation.

At column 5, lines 1-7, Gibson et al. discloses moving nodes that represent objects on a three-dimensional surface (col. 3, lines 22-26). Contrary to the Examiner's assertion, just because this section of Gibson et al. uses the words "node," "weighted," and "distance" does not mean that this section of Gibson et al. discloses a processor to determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network, as recited in claim 47. In fact, Gibson et al. is related to generating a surface model for a three-dimensional object (col. 2, lines 20-21). The disclosure of Gibson et al. has absolutely nothing to do with communication networks. Due to the divergent subject matter of the Gibson et al. disclosure, there could be no reasonable explanation as to why one of ordinary skill in the art at the time of Appellants' invention would have sought to incorporate any feature of Gibson et al. into the combined system of Garg et al., Li et al., Liao et al., and Gibson et al.

For at least these reasons, Appellants submit that the rejection of claim 47 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. is improper. Accordingly, Appellants request that the rejection be reversed.

F. The rejection under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., and Gibson et al. in view of Proctor, Jr. et al. should be reversed.

1. Claim 45

Claim 45 depends from claim 43. Without acquiescing in the Examiner's rejection of claim 45, Appellants submit that the disclosure of Proctor, Jr. et al. does not cure the deficiencies in the disclosures of Garg et al., Li et al., Liao et al., and Gibson et al. identified above with regard to claim 43. Therefore, Appellants submit that the rejection of claim 45 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., Liao et al., Gibson et al., and Proctor, Jr. et al., is improper for at least the reasons given above with respect to claim 43. Accordingly, Appellants request that the rejection be reversed.

G. The rejection under 35 U.S.C. § 103(a) based on Garg et al. and Li et al., and Liao et al. should be reversed.

1. Claim 48

Independent claim 48 is directed to a system for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes. The system comprises means for identifying a geographic center of the non-biconnected network based on current locations of the nodes; and means for causing each of one or more of the nodes to move towards the geographic center to transform the non-biconnected network to a biconnected network.

Garg et al., Li et al., and Liao et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 48. For example, Garg et al., Li et al., and Liao et al., do not disclose or suggest means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network. The Examiner appears to rely on sections 3.1, 3.2, and 4.4 of Garg et al., section 1 of Li et al., and sections 3.1 and 3.3 and pages 6, 8, and 15 of Liao et al. as allegedly disclosing this feature of claim 48 (final Office Action, pp. 28-29).

In section 3.1, Garg et al. discloses an algorithm that picks a set of edges that form a 2-vertex connected spanning subgraph and partitions the vertices into blocks that are used to modify the set of edges. Assuming, for the sake of argument, that the blocks of Garg et al. can be construed as corresponding to the nodes of claim 48 (a point that Appellants do not concede), Garg et al. does not disclose or suggest moving the blocks, let alone moving the blocks toward a geographic center, as would be required by Garg et al. based on the Examiner's interpretation of claim 48. Therefore, this section of Garg et al. does not disclose or suggest means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48.

In section 3.2, Garg et al. discloses that the total number of edges picked is at most (3/2)OPT. This section of Garg et al. has nothing to do with moving nodes. Therefore, nowhere in this section, or elsewhere, does Garg et al. disclose or suggest means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48.

In section 4.4, Garg et al. discloses an algorithm that finds all 2-vertex connected components in a graph, creates a depth first search (DFS) tree in which all of the edges are included in the subgraph, and partitions the vertex set into blocks. Assuming, for the sake of argument, that the blocks of Garg et al. can be construed as corresponding to the nodes of claim 48 (a point that Appellants do not concede), Garg et al. does not disclose or suggest moving the blocks, let alone moving the blocks toward a geographic center, as would be required by Garg et al. based on the Examiner's interpretation of claim 48. Therefore, this section of Garg et al. does not disclose or

suggest means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48.

As noted above, in section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path between hosts A and B. This section of Li et al. discloses moving hosts to send a message. This section of Li et al. does not disclose or suggest means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48.

As noted above, Appellants have carefully reviewed sections 3.1 and 3.3 and pages 6, 8, and 15 of Liao et al. and find absolutely no disclosure similar to means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48. Instead, Liao et al. simply discloses selecting a gateway host of a grid as the one nearest to the physical center of the grid (sections 3.1 and 3.3).

The Examiner has not explained how the above sections of Garg et al., Li et al., or Liao et al. can reasonably be construed as disclosing means for causing each of one or more of the nodes to move towards the geographic center to transform a non-biconnected network to a biconnected network, as recited in claim 48. As such, a *prima facie* case of obviousness has not been established with regard to claim 48.

Furthermore, Appellants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper.

For at least these reasons, Appellants submit that the rejection of claim 48 under 35 U.S.C. § 103(a) based on Garg et al., Li et al., and Liao et al. is improper. Accordingly, Appellants request that the rejection be reversed.

H. The rejection under 35 U.S.C. § 103(a) based on Hsu and Li et al. should be reversed.

1. Claims 50-52

Independent claim 50 is directed to a method for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes. The method comprises determining initial positions of the nodes in the one-dimensional non-biconnected network; determining a movement schedule for the nodes using one or more linear programming techniques; and causing one or more of the nodes to move based on the determined movement schedule to form a biconnected network from the one-dimensional non-biconnected network.

Hsu and Li et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 50. For example, Hsu and Li et al. do not disclose or suggest determining a movement schedule for the nodes using one or more linear programming techniques.

The Examiner alleged that Li et al. discloses determining a movement schedule and Hsu discloses using linear programming (final Office Action, pp. 30-31). Applicants strenuously object to the Examiner's piecemeal examination. It is wholly unreasonable for the Examiner to dissect a claim feature into a few words at a time and cite to unrelated sections of different references for allegedly disclosing these words. Thus, the Examiner's rejection is improper and based solely on hindsight.

In the abstract, Hsu discloses a technique for adding a minimum number of edges to an undirected graph in order to obtain a biconnected graph. Nowhere in this section, or elsewhere, does Hsu disclose or suggest determining a movement schedule, let alone determining a movement schedule for the nodes using one or more linear programming techniques, as recited in claim 50.

As noted above, in section 1, Li et al. discloses developing an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path between hosts A and B. While this section of Li et al. discloses moving hosts, this section of Li et al. does not disclose determining a movement schedule. Therefore, this section of Li et al. does not disclose or suggest determining a movement schedule for the nodes using one or more linear programming techniques, as recited in claim 50.

Because neither Hsu or Li et al. discloses the feature of determining a movement schedule for the nodes using one or more linear programming techniques, the combination of Hsu and Li et al. cannot disclose or suggest this feature. Thus, the Examiner has not established a prima facie case of obviousness with regard to claim 50.

For at least these reasons, Appellants submit that the rejection of claim 50 under 35 U.S.C. § 103(a) based on Hsu and Li et al. is improper. Accordingly, Appellants request that the rejection be reversed.

Claims 51 and 52 depend from claim 50. Therefore, Appellants submit that the rejection of claims 51 and 52 under 35 U.S.C. § 103(a) based on Hsu and Li et al. is improper for at least the reasons given above with respect to claim 50. Accordingly, Appellants request that the rejection be reversed.

2. Claim 54

Independent claim 54 is directed to a system for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes. The system comprises means for determining initial positions of the nodes in the one-dimensional non-biconnected network; means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network; and means for causing one or more of the nodes to move based on the determined movement schedule to achieve biconnectivity in the one-dimensional non-biconnected network.

Hsu and Li et al., whether taken alone or in any reasonable combination, do not disclose or suggest the combination of features recited in claim 54. For example, Hsu and Li et al. do not disclose or suggest means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network.

The Examiner alleged that Hsu, at the abstract and sections 1 and 3, and Li et al., at section 1, disclose the above-identified feature of claim 54 (final Office Action, pp. 31-32). Applicants submit that the disclosures of Hsu and Li et al. do not support the Examiner's allegation.

In the abstract, Hsu discloses a technique for adding a minimum number of edges to an undirected graph in order to obtain a biconnected graph. Nowhere in this section, or elsewhere, does Hsu disclose or suggest determining a movement schedule (as admitted by the Examiner at pg. 31 of the final Office Action), let alone means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network, as recited in claim 54.

In section 1, Hsu discloses a linear-time sequential algorithm for identifying a set of edges to add to an undirected graph in a single execution. Nowhere in this section, or elsewhere, does Hsu disclose or suggest determining a movement schedule (as admitted by the Examiner at pg. 31 of the final Office Action), let alone means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network, as recited in claim 54.

In section 3, Hsu discloses an algorithm for adding a set of edges to a graph. Nowhere in this section, or elsewhere, does Hsu disclose or suggest determining a movement schedule (as admitted by the Examiner at pg. 31 of the final Office Action), let alone means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network, as recited in claim 54.

In section 1, Li et al. discloses an algorithm for computing a trajectory for sending a message from host A to host B by recruiting intermediate hosts to change their trajectory in order to complete a routing path between hosts A and B. While this section of Li et al. discloses moving hosts, this section of Li et al. has nothing to do with determining a movement schedule optimally in polynomial time. Therefore, nowhere in this section, or elsewhere, does Li et al. disclose or suggest means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network, as recited in claim 54.

Because neither Hsu or Li et al. discloses the feature of means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and

a number of the nodes in the one-dimensional non-biconnected network, the combination of Hsu and Li et al. cannot disclose or suggest this feature. Thus, the Examiner has not established a prima facie case of obviousness with regard to claim 54.

For at least these reasons, Appellants submit that the rejection of claim 54 under 35 U.S.C. § 103(a) based on Hsu and Li et al. is improper. Accordingly, Appellants request that the rejection be reversed.

I. The rejection under 35 U.S.C. § 103(a) based on Hsu and Li et al. in view of Lin et al. should be reversed.

1. Claim 53

Claim 53 depends from claim 50. Without acquiescing in the Examiner's rejection of claim 53, Appellants submit that the disclosure of Lin et al. does not cure the deficiencies in the disclosures of Hsu and Li et al. identified above with regard to claim 50. Therefore, Appellants submit that the rejection of claim 53 under 35 U.S.C. § 103(a) based on Hsu, Li et al., and Lin et al. is improper for at least the reasons given above with respect to claim 50.

2. Claim 55

Claim 55 depends from claim 54. Without acquiescing in the Examiner's rejection of claim 55, Appellants submit that the disclosure of Lin et al. does not cure the deficiencies in the disclosures of Hsu and Li et al. identified above with regard to claim 54. Therefore, Appellants submit that the rejection of claim 55 under 35 U.S.C. § 103(a) based on Hsu, Li et al., and Lin et al. is improper for at least the reasons given above with respect to claim 54.

VIII. CONCLUSION

In view of the foregoing arguments, Appellants respectfully solicit the Honorable Board to reverse the Examiner's rejections of claims 1-55.

Applicants believe no fee is due with this response other than as reflected on the enclosed Appeal Brief Transmittal. However, if a fee is due, please charge our Deposit Account No. 18-1945, under Order No. BBNT-P01-253 from which the undersigned is authorized to draw.

Dated: November 10, 2008

Respectfully submitted,

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IX. APPENDIX

1. A method for achieving biconnectivity in a network that includes a plurality of nodes, the method comprising:

forming blocks from groups of one or more of the nodes in the network;

selecting one of the blocks as a root block;

identifying other ones of the blocks as leaf blocks; and

collectively moving the nodes in one or more of the leaf blocks to make the network biconnected.

2. The method of claim 1, wherein the forming blocks includes:

generating a graph of a current view of a topology of the network, and

generating a block tree based on the current view of the topology of the network, the block tree organizing the nodes into one or more blocks.

3. The method of claim 2, wherein the generating a graph includes:

determining locations of the nodes in the network, and

determining the current view of the topology of the network based on the locations of the nodes in the network.

4. The method of claim 3, wherein the determining locations of the nodes includes:

periodically receiving updates from the nodes, each of the updates includes a location of a corresponding one of the nodes.

5. The method of claim 4, wherein the determining locations of the nodes further includes:

extracting neighbor information from the updates.

6. The method of claim 1, further comprising:

identifying cutvertices in the network.

7. The method of claim 6, wherein the collectively moving the nodes in one or more of the leaf blocks includes:

moving one or more of the leaf blocks to remove one or more of the cutvertices from the network.

8. The method of claim 1, wherein the selecting one of the blocks includes:

identifying one of the blocks that includes a maximum number of nodes as the root block.

9. The method of claim 1, wherein the collectively moving the nodes in one or more of the leaf blocks includes:

moving all of the nodes within one of the leaf blocks collectively when the leaf block is moved without changing connectivity within the leaf block.

10. The method of claim 1, wherein the one or more of the leaf blocks are moved while minimizing a total distance moved by all of the nodes in the network.

11. The method of claim 1, wherein the collectively moving the nodes in one or more of the leaf blocks includes:

moving one of the leaf blocks, as a particular leaf block, towards a nearest node in another one of the blocks.

12. The method of claim 11, wherein the particular leaf block is moved towards the nearest node until at least one new edge appears between the particular leaf block and the other one of the blocks.

13. The method of claim 1, wherein the collectively moving the nodes in of one or more of the leaf blocks is performed iteratively until the network is biconnected.

14. The method of claim 1, wherein the collectively moving the nodes in of one or more of the leaf blocks is performed after final positions for the one or more of the leaf blocks is determined.

15. The method of claim 1, wherein the method is performed by one or more of the nodes in the network.

16. The method of claim 1, wherein the method is performed by each of the nodes in the network.

17. The method of claim 1, wherein the nodes are capable of moving on their own.

18. The method of claim 1, wherein the nodes include robotic nodes.

19. A system for achieving biconnectivity in a network that includes a plurality of nodes, comprising:

means for grouping subsets of the nodes into blocks;

means for identifying cutvertices in the network; and

means for collectively moving the subset of nodes in one or more of the blocks for a number of iterations to remove the cutvertices from the network.

20. The system of claim 19, where the means for collectively moving includes means for moving the subset of nodes in one of the blocks toward one of the nodes in another one of the blocks.

21. In a network that includes a plurality of nodes, at least one of the nodes comprising:

a network device that is capable of moving within the network; and

a movement controller configured to:

generate a current view of the network,

form blocks from groups of one or more of the nodes in the network based on the current view of the network, and

identify one or more of the blocks, as one or more identified blocks, to move to make the network biconnected.

22. The at least one node of claim 21, wherein the movement controller is further configured to instruct the network device to move to a particular location when the at least one node is one of the nodes in one of the one or more identified blocks.

23. The at least one node of claim 22, wherein all of the nodes within the one of the one or more identified blocks move collectively.

24. The at least one node of claim 21, wherein when generating a current view of the network, the movement controller is configured to:

determine locations of the nodes in the network, and

determine a current topology of the network based on the locations of the nodes in the network.

25. The at least one node of claim 24, wherein when determining locations of the nodes, the movement controller is configured to periodically receive updates from the nodes, each of the updates including a location of the corresponding node.

26. The at least one node of claim 25, wherein when determining locations of the nodes, the movement controller is further configured to extract neighbor information from the updates.

27. The at least one node of claim 21, wherein the movement controller is further configured to identify cutvertices in the network.

28. The at least one node of claim 27, wherein when identifying one or more of the blocks to move, the movement controller is configured to identify a distance and direction to move the one or more identified blocks so as to remove one or more of the cutvertices from the network.

29. The at least one node of claim 21, wherein the movement controller is further configured to:

identify one of the blocks that includes a maximum number of nodes as a root block, and

identify other ones of the blocks as leaf blocks, the one or more identified blocks being ones of the leaf blocks.

30. The at least one node of claim 21, wherein the movement controller is further configured to determine a distance and direction that the one or more identified blocks should move.

31. The at least one node of claim 30, wherein the one or more identified blocks are moved so as to minimize a total distance moved by all of the nodes in the network.

32. The at least one node of claim 30, wherein each of the one or more identified blocks, as a particular block, is to move towards a nearest node in a parent block.

33. The at least one node of claim 32, wherein the particular block is to move towards the nearest node until at least one new edge appears between the particular block and the parent block.

34. The at least one node of claim 21, wherein moving of the one or more identified blocks is performed iteratively until the network is biconnected.

35. The at least one node of claim 21, wherein moving of the one or more identified blocks is performed after final positions for the one or more identified blocks is determined.

36. The at least one node of claim 21, wherein the at least one node includes all of the nodes in the network.

37. The at least one node of claim 21, wherein the nodes include robotic nodes.

38. A method for achieving biconnectivity in a network that includes a plurality of nodes, the method comprising:

generating a graph of the network;

identifying cutvertices in the network; and

causing one or more of the nodes in the network to move to systematically remove the cutvertices from the network and form a biconnected network.

39. A method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the method comprising:

identifying one or more of the nodes to move;

determining direction and distance to move the one or more nodes; and

moving the one or more nodes in the determined direction and distance to transform the non-biconnected network to a biconnected network.

40. The method of claim 39, wherein the identifying one or more of the nodes to move includes:

forming blocks from groups of at least one of the nodes in the non-biconnected network,

selecting one of the blocks as a root block, and

identifying other ones of the blocks as leaf blocks.

41. The method of claim 40, wherein the one or more nodes are included in one or more of the leaf blocks.

42. The method of claim 41, wherein the moving the one or more nodes includes:

moving the one or more nodes collectively with other ones of the one or more nodes within a same one of the leaf blocks.

43. The method of claim 39, wherein the determining direction and distance to move includes:

determining a geographic center of the non-biconnected network, and

determining weighted distances for moving the one or more nodes toward the geographic center.

44. The method of claim 43, wherein the weighted distances are related to distances that the nodes are from the geographic center.

45. The method of claim 43, wherein the direction for a particular node of the one or more nodes includes a straight line joining a starting position of the particular node and the geographic center.

46. A method for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the method comprising:

determining a geographic center of the non-biconnected network; and

moving each of one or more of the nodes a weighted distance towards the geographic center to transform the non-biconnected network to a biconnected network.

47. In a network that includes a plurality of nodes, at least one of the nodes comprising:

a network device that is capable of moving within the network; and

a movement controller configured to:

determine locations of the nodes,

identify a geographic center of the network based on the locations of the nodes, and

determine a weighted distance that each of the nodes should move toward the geographic center to achieve biconnectivity in the network.

48. A system for achieving biconnectivity in a non-biconnected network that includes a plurality of nodes, the system comprising:

means for identifying a geographic center of the non-biconnected network based on current locations of the nodes; and

means for causing each of one or more of the nodes to move towards the geographic center to transform the non-biconnected network to a biconnected network.

49. A computer-readable medium that includes instructions that when executed by at least one processor causes the processor to perform a method for achieving biconnectivity in a network that includes a plurality of nodes, the computer-readable medium comprising:

instructions for determining a current topology of the network;

instructions for identifying cutvertices in the network based on the current topology of the network;

instructions for identifying one or more of the nodes in the network to move; and

instructions for causing each of the identified one or more nodes to move in a particular direction to systematically remove the cutvertices from the network and form a biconnected network.

50. A method for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes, comprising:

determining initial positions of the nodes in the one-dimensional non-biconnected network;

determining a movement schedule for the nodes using one or more linear programming techniques; and

causing one or more of the nodes to move based on the determined movement schedule to form a biconnected network from the one-dimensional non-biconnected network.

51. The method of claim 50, wherein the determining a movement schedule includes:

determining the movement schedule as an objective function,

converting the objective function into a linear programming representation, and

solving the linear programming representation optimally in polynomial time.

52. The method of claim 51, wherein the linear programming representation is solved as a function of a number of nodes in the one-dimensional non-biconnected network.

53. The method of claim 50, wherein each of the nodes in the biconnected network is capable of communicating with other ones of the nodes in the biconnected network one and two hops away.

54. A system for achieving biconnectivity in a one-dimensional non-biconnected network that includes a plurality of nodes, comprising:

means for determining initial positions of the nodes in the one-dimensional non-biconnected network;

means for determining a movement schedule optimally in polynomial time based at least in part on the initial positions of the nodes and a number of the nodes in the one-dimensional non-biconnected network; and

means for causing one or more of the nodes to move based on the determined movement schedule to achieve biconnectivity in the one-dimensional non-biconnected network.

55. The system of claim 54, wherein each of the nodes is capable of communicating with other ones of the nodes one and two hops away after biconnectivity is achieved in the one-dimensional non-biconnected network.

X. EVIDENCE APPENDIX

None

XI. RELATED PROCEEDINGS APPENDIX

None